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JRAIA's comments on Öko-Recherche's briefing paper: "HFCs and HFC alternatives in split air conditioning systems"

JRAIA, the Japan Refrigeration and Air Conditioning Industry Association, is the industry association representing over 160 manufacturers of refrigeration and air-conditioning equipment in Japan. We would like to thank European Commission for giving us the opportunity to comment on the Öko-Recherche's briefing paper "HFCs and HFC alternatives in split air conditioning systems" provided on 18th March 2020.

From a perspective of HVAC&R industry, which is dedicated to the development of technologies and energy-efficient products using low-GWP refrigerants for HFC phasedown, we would like to provide our comments in the attached ANNEX. As one of the key stakeholders active in Europe, JRAIA hopes that our comments will be considered in the Commission's decision on the endorsement of the final report.

Yours sincerely,

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About JRAIA

The Japan Refrigeration and Air Conditioning Industry Association (JRAIA) was originally established in February 1949 as the Japan Refrigerating Machine Manufacturers Association which was thereafter reorganized in February 1969 to become an incorporated association and renamed as it is at present.

JRAIA is the industry association representing over 160 manufacturers of refrigeration and air conditioning equipment in Japan. We, the members of JRAIA, have so far been dedicated to offering quality products to the markets of EU. JRAIA aims to promote and improve production, distribution and consumption of refrigeration and air conditioning equipment and their applied products, as well as auxiliary devices and components, automatic controls and accessories and thereby contribute to the steady development of Japanese industry and the improvement in people's standard of living.

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ANNEX

JRAIA's comments on Öko-Recherche's briefing paper
"HFCs and HFC alternatives in split air conditioning systems"

Key Messages

(1) There is no persuasive evidence to support Öko-Recherche's claim that R290's performance including energy efficiency level and cost efficiency are almost equivalent to that of R32.

Öko-Recherche claims that "Energy efficiency levels of R290 split units are very similar compared to R32 units" on page 7. JRAIA would like to share our concern that large size products will be required to cover diminished energy efficiency entailed by the transition to R290.

(2) Risk assessment by the whole air conditioning industry per se is required for the safe use of A3 refrigerants. Easing of building codes promotes the use of A2L refrigerants which is a more plausible solution to reducing CO_2 emissions promptly.

A3 refrigerants are highly flammable and it is imperative to identify all possible hazards. Given the current situation, we would like to emphasize that much more time is required for the establishment of standards and risk assessment for A3 refrigerants by the air conditioning industry per se in the EU, which is the key to ensuring product safety. We strongly believe that further penetration of the latest products using A2L refrigerants is a more applicable and plausible solution, and to achieve this, establishment of related standards as well as easing of building codes is required urgently.

(3) Enhancing the smooth but voluntary transition toward lower GWP refrigerants for heat pumps should be considered instead of introduction of an additional GWP regulation

JRAIA would like to emphasize the great potential of heat pumps for the reduction in CO_2 emissions. Further penetration of heat pumps should be prompted with an emphasis on the smooth but voluntary transition toward lower GWP refrigerants instead of an additional GWP regulation.

I Introduction

When considering alternative refrigerants, various criteria including GWP, energy efficiency, safety, equipment size, cost effectiveness must be taken into account, and trade-offs between GWP and other factors are inevitable. Currently, several tens of millions air conditioners using A2L refrigerants including R32 are up and running around the globe, and the penetration are rapidly increasing especially in Asia and Europe. The number of these equipment proves that the market as well as end users concur with the fact that the use of A2L refrigerants is appropriate. Öko-Recherche's report states the transition to A2L alternatives will contribute to the reduction in CO_2 emissions. Therefore, JRAIA strongly believes that further penetration of the latest products using A2L refrigerants are applicable as a solution.

II Existing barriers of building codes and standards

Öko-Recherche's report positions EN60335-2-40, which is one of the product safety standards, as overarching standard, and claims that the slow process of setting the EN standard is one of the obstacles for the penetration of low GWP refrigerants. In 2018, IEC60335-2-40 Ed6.0, which is a global standard and the base of EN60335-2-40, covering safety requirements for the use of A2L refrigerants, has already been approved. If EN60335-2-40 had been updated to harmonize with Edition 6.0, it would easily put a part of this obstacle aside, and further promote the penetration of the low-GWP products using A2L refrigerants.

The report also states that the revision of building codes in Spain and Italy has enhanced the penetration of R32 equipment, but building codes restricting the use of flammable refrigerants including A2L refrigerants in French public and also in high rise buildings remain a barrier to the low GWP refrigerants. In the report, refrigerants for VRFs are not explicitly mentioned, but JRAIA believes that the appropriate revision of building codes will also expand the use of A2L refrigerants to VRFs, which has high potential to contribute to the reduction in CO_2 emissions.

III Risk assessment required for the safe use of A3 refrigerants

Öko-Recherche also states "the need for trainings on flammable refrigerant use for installers and service companies", and "the need of further updating EN standards to apply global standards such as IEC60335-2-40". This is also true to A3 refrigerants. It is necessary to comply with product safety standards to supply secure products with reasonable manufacturing costs and some of the safety requirements including limitations on refrigerant charge amount (max 1.0kg) can be covered by product safety standards, but considering that HC refrigerants are highly flammable, it is imperative to identify all possible hazards with equipment. Therefore, risk assessment conducted by the whole equipment manufacturers per se in the EU is essential in order to establish the safety requirements for installation and servicing. This is a time-consuming process. Looking back at the path which current A2L refrigerants have taken, it is clear that it will take a considerable amount of time to remedy these situations. To sum up, at this moment, JRAIA concludes that it is difficult to commercialize HC refrigerant-based air conditioning products on a full scale.

IV Energy efficiency

JRAIA concurs with Öko-Recherche suggesting that in addition to GWP, various aspects of alternative refrigerants including energy efficiency and safety must be sought. However, we would like to point out that some of the statements for R290's energy efficiency and refrigerant charge amount are not accurate.
In the report, the energy efficiency and charge size of alternatives such as R32 and HCs including R290 are compared to those of R410A as baseline refrigerant. It may look appropriate for the EU market to make comparison between alternative candidates and R410A, but it is common knowledge that R290 is not an alternative to R410A, but to R22. In the reference paper (paper by Abdelaziz et al), R32 and R452B etc. are described as alternatives to R410A, and R290 is examined as an alternative to R22. This comes down to the fact that theoretical volumetric capacity of R290 is 40% lower than that of R410A, whereas R32 has 10% higher theoretical volumetric capacity than R410A, which leads to considerable drops in cooling / heating efficiency in drop-in tests. Therefore, to make meaningful comparison of R290 and R32 or R410A, there will be

need for a significantly larger compressor for R290. It is clear that the comparison of energy efficiency results from different baseline equipment will not give the correct answer, considering the difference in test equipment sizes.
The report also makes the reference to the paper by Dr. Devotta. In this reference paper, simulation results of R290 and R32 are shown in comparison with R22 as baseline refrigerant. The results using the same R22 baseline model show the cooling capacity and efficiency of R290 in drop-in test conditions are 90.3% and 111% respectively and the cooling capacity and efficiency of R32 are over 15% higher than R290. In this paper, tests with a compressor with 10% higher capacity, or with a condenser with 30% larger condenser area, or with a condenser using small diameter tubes are carried out, but those test results show R32 has higher energy efficiency, compared to R290.
As a result, Öko-Recherche's claim that R290 has almost the same efficiency level as R32 has overlooked the decrease in air conditioning capacity or the need for larger size products.
The report indicates that air conditioners up to 7kW using R290 are commercially available in China and India. But it should be taken into account whether the efficiency or the size of those air conditioners are the same as R410A models or R32 products.

V Refrigerant charge size

The report states the refrigerant charge amount of R290 can be 40% less compared to R410A. However, the RTOC report in 2014 which we presume is the basis for this reduction in the report, only shows the comparative figures of R22 and R290, and 40% reduction will not be correct description. In addition, charge sizes of R32 are described under the prerequisite of the same performance level as R410A. In order to say that this is correct evaluation, the percentage of the charge reduction for R290 must be also on the same baseline with R32.

VI R454C

This report lists R290, R161, and R454C (mixture of R32 and R1234yf) as refrigerant candidates below GWP150. Although there is no solid scientific evidence in the report, these refrigerants are suggested as alternatives for small size air conditioning equipment in the conclusion. Our comments on the energy efficiency of R290 is already stated in section IV, so in this section, we would like to raise a concern for R454C use in residential air conditioners. Numerous drop-in test results of mixtures of R32 and R1234yf using R410A models have been published. In the light of cooling COP, the test results show that the mixture of 80% 1234yf and 20% R32, which has a GWP of approximately 150, has the lowest performance among various compositions of them. To be specific, the findings of the test show that approx. 15% decline in rated cooling COP, and approx. 50% decline in rated heating COP in reversible air to air heat pump than one with R410A. Also, the studies on TEWI using these data indicate TEWI for mixed refrigerant equivalent to GWP150 is higher than that for R410A. In other words, R454C, mixed refrigerant of 78.5% 1234yf and 21.5% R32, cannot be a drop-in replacement, and if commercialized, a larger size compressor and larger heat exchanger would be required. It may reduce a GWP of refrigerant, but it requires significant cost increase in order to help to mitigate climate impact.　.

VII Heat pumps

Heat pumps have the capability of reducing CO_2 emissions by approximately 60% compared to oil boilers and by approximately 50% compared to natural gas boilers. Therefore, expectations are high that heat pump technology will contribute to immediate reduction in CO_2 emissions and will be one of the key technologies to attain the net zero emissions in the distant future.
As split air conditioners in Europe are not only used for cooling but also for heating, heat pumps have a great potential for the reduction in CO_2 emissions, further penetration of heat pumps should be prompted with an emphasis on the voluntary transition to lower GWP refrigerants by the heat pump industry instead of applying a GWP regulation to this application.

REFERENCE

1.Omar Abdelaziz and Som S. Shrestha, Evaluation of Alternative Refrigerants for Mini-Split Air Conditioners, ASHRAE WINTER CONFERENCE 2017

2.Sukumar Devotta and A. S. Padalkar, and K. V. Mali, 2016, Low GWP refrigerants as alternatives to HCFC-22 in room air conditioners, Science and Technology for the Built Environment

3.UNEP, 2014, 2014 Report of the Refrigeration, air-conditioning and heat pumps, Technical Options Committee (RTOC), UNEP

4.Daniel Colbourne & K. O. Suen, 2015, Comparative evaluation of risk of a split air conditioner and refrigerator using hydrocarbon refrigerants, Science Volume 59 2015

5.Hideaki Hara, Masao Oono, and Ikuhiro Iwata, Experimental Study of Low GWP Refrigerants for Room Air-Conditioners, 2010, International Symposium on Next-generation Air Conditioning and Refrigeration Technology, February 17-19